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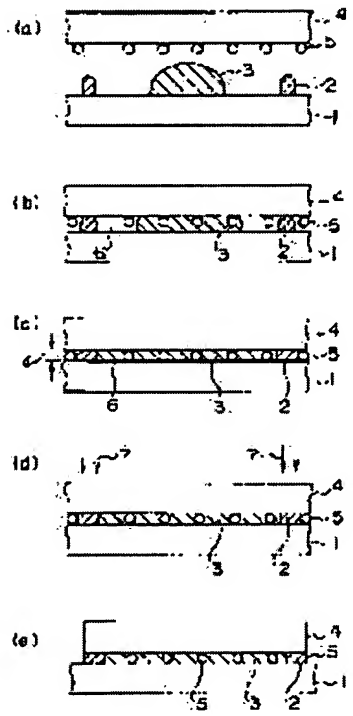
(54) PRODUCTION OF LIQUID CRYSTAL DISPLAY PANEL

(57)Abstract:

PURPOSE: To prevent a sealing defect by uniformly distributing spacers over the entire part of a liquid crystal panel at the time of sealing liquid crystals between substrates by a vacuum dropping method in the process for producing the liquid crystal display panel formed by dropping a liquid crystal material between the substrates and sealing the liquid crystal material between the substrates facing each other.

CONSTITUTION: The max. diameter of the spacers 5 adhered and fixed between a pair of the substrates 1 and 4 is smaller by at least 0.2 to 0.6μm than the thickness of the liquid crystal layer held between the substrates 1 and 4. The spacers 5 are coated with adhesives and the viscosity of the sealing material 2 for sealing the liquid crystals is specified to ≥50000cps.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the manufacture approach of the liquid crystal display panel which closes and forms a liquid crystal ingredient between the substrates which trickle a liquid crystal ingredient into a substrate and counter it in more detail about the manufacture approach of a liquid crystal display panel.
[0002]
[Description of the Prior Art] The liquid crystal display is used in the field large as a display from points, like thickness is thinly lightweight and there is little power consumption. The liquid crystal panel for displaying the alphabetic character and image which are the principal part of a liquid crystal display has the first substrate with which the transparent electrode was formed, and the second substrate with which drive circuits, such as TFT, were formed, and the liquid crystal ingredient is enclosed among those substrates.
[0003] As an approach of enclosing liquid crystal between the substrates of a pair, there are a vacuum pouring-in method and the vacuum dropping pouring-in method, for example. The vacuum pouring-in method lays two substrates on top of a part at intervals of predetermined on both sides of the closure member of the shape of a frame which has opening, and constitutes an empty cel. If put this empty cel into a chamber, and opening of an empty cel is continuously changed into a reduced pressure condition the interior and dipped in a liquid crystal ingredient, next nitrogen etc. is introduced into a chamber and the pressure inside a chamber is made high The difference of the internal atmospheric pressure of an empty cel and the atmospheric pressure in a chamber is absorbed and filled up with a liquid crystal ingredient in an empty cel. For example, it is proposed by the Provisional-Publication-No. 62-No. 89025 official report.
[0004] However, according to this approach, when creating a large-sized liquid crystal panel, the purge timing for making the inside of a chamber into a vacuum starts for a long time. Moreover, since a lot of [in order to dip an empty cel] liquid crystal ingredients are required, cost becomes high. Moreover, it takes the time and effort which closes opening after liquid crystal enclosure, and the time and effort which washes the liquid crystal adhering to the perimeter of opening. On the other hand, the vacuum dropping pouring-in method has many advantages. Drawing 6 is the perspective view having shown roughly the closure process of the liquid crystal broken into the vacuum dropping pouring-in method, and is drawing 6 (a). - (c) It is each process, respectively.
[0005] drawing 6 (a) **** -- it adheres to the sealant 22 which consists of photo-curing mold resin on the first substrate 21 in which a pixel electrode, a TFT component, the orientation film, etc. were formed in the shape of a frame. Moreover, liquid crystal 23 is dropped inside the frame of this sealant 22. Moreover, a transparent electrode and the orientation film are formed also in the second substrate 24, and the field by the side of the transparent electrode formation counters the pixel electrode forming face of the first substrate 21. The spacer (not shown) is sprinkled by homogeneity on the orientation film of the second substrate 24. This spacer is an almost spherical particle with a diameter of several

micrometers which consists of resin etc., and when the first and the second substrate 21 and 24 are made to rival, it is used in order to make the gap between substrates 21 and 24 (gap) into homogeneity over the whole panel.
[0006] Next, drawing 6 (b) The second substrate 24 which adhered the spacer to the first substrate 21 which trickled liquid crystal 23 is piled up in a vacuum so that it may be shown. And a sealant 22 touches the second substrate 24, and if a perimeter is made into atmospheric pressure from a vacuum, the first and the second substrate 21 and 24 can draw near according to the atmospheric-pressure difference of cel inside and outside in the place where a closed space was formed with the frame of a sealant 22 between the first and the second substrate 21 and 24. Liquid crystal 23 spreads in a longitudinal direction between the first and the second substrate 21 and 24 at a radial as the first and second spacing of the electrode substrates 21 and 24 narrows at this time.
[0007] Thereby, it is drawing 6 (c). It fills up with liquid crystal 23 within the limit of the sealant 22 between the first and the second substrate 21 and 24 completely so that it may be shown. Here, the gap between the first and the second substrate 21 and 24 is equalized over the whole panel by the spacer. Moreover, re-alignment for doubling the mutual location of the first and the second substrate 21 and 24 with a precision on pixel level at this time is performed. This is performed by moving the first substrate 21 or second substrate 24 to a longitudinal direction. If re-alignment is completed, ultraviolet rays will be irradiated, a sealant 22 will be stiffened and the closure of liquid crystal will be completed.
[0008]
[Problem(s) to be Solved by the Invention] However, there were the following troubles by the manufacture approach of such a liquid crystal display panel. First, in case liquid crystal is dropped at one substrate and two substrates are stretched, the rapid flow of liquid crystal arises between two substrates. Therefore, the spacer made to adhere to homogeneity beforehand moved by the rapid flow of liquid crystal, and it spread in the radial from the center of a panel, and it might incline annularly and might incline near the sealant of a panel edge. Thus, when unevenness arose in spacer distribution, the gap between substrates in a panel side becomes an ununiformity, and the engine performance of a liquid crystal panel might be reduced.
[0009] Moreover, depending on the relation between the diameter of a spacer, and the gap thickness between substrates, the spacer and the substrate front face might contact strongly beyond the need. For this reason, when moving a substrate for re-alignment, the substrate front face was contacted strongly, the orientation film and an electrode layer might be damaged or the spacer might bar migration of a substrate. Moreover, since a closure member was still in a soft condition by un-hardening when filled up although carried out using the differential pressure of the inside of the frame of a closure member, and an outside in case the cel between substrates is filled up with liquid crystal, the crack might arise in the closure member with the pressure, and the poor closure might occur.
[0010] Drawing 7 showed the liquid crystal display panel which the such poor closure generated, and two kinds of cracks 22a and 22b have produced it in the closure member 22 pinched by the first and the second substrate 21 and 24. One crack 22a is produced from the outside of the frame of the closure member 22 with the pressure of the atmospheric air which works inside, when the inside of the frame of the closure member 22 is a vacuum. Crack 22b of another side is produced from the inside of a frame 22 in many cases with the pressure of the liquid crystal ingredient 23 which works outside, or the compatibility of liquid crystal and a sealant. If such cracks 22a and 22b arise in the closure member 22, a liquid crystal ingredient will leak from a cel, or air will enter in a cel, and the display property of a liquid crystal display panel will be reduced.
[0011] Moreover, there is contamination of liquid crystal as one of the factors related to the display engine performance of a liquid crystal display panel. It can ask for contamination of this liquid crystal by measuring the electrical-potential-difference retention between the counterelectrodes which sandwich liquid crystal. The capacity to maintain the potential difference of a counterelectrode is so high that this electrical-potential-difference retention is high, and the capacity to drive liquid crystal is high. The graph of drawing 8 measured change of the electrical-potential-difference retention by the time amount of an exposure of the ultraviolet rays for closure member hardening at the center and edge of a liquid crystal

display panel. Axes of abscissa are [UV irradiation time amount and the axis of ordinate of this graph] the electrical-potential-difference retention of liquid crystal, and A is [the center of a display panel and B of the line of a graph] the things near the closure member of a display panel. Even if the electrical-potential-difference retention of the liquid crystal of a liquid crystal display panel center section irradiates long duration ultraviolet rays, it hardly changes, as this graph shows, but the electrical-potential-difference retention of the liquid crystal near the closure member of a liquid crystal display panel is falling, so that UV irradiation time amount becomes long. In addition, UV irradiation conditions were performed within the limits of a manufacturer's recommendation conditions.

[0012] This is for liquid crystal and a closure member reacting, and the resultant's melting into liquid crystal, and polluting liquid crystal, when ultraviolet rays are irradiated by the liquid crystal near the closure member. Although contamination of this liquid crystal is produced near the closure member, it spreads with the passage of time and the engine performance of the whole liquid crystal display panel is reduced. In case this invention is made in view of such a conventional trouble and liquid crystal is closed between substrates by the vacuum dropping pouring-in method, while distributing a spacer over homogeneity over the whole liquid crystal panel, equalizing the gap between substrates, and raising the display engine performance of a liquid crystal display panel and preventing damage on the substrate side by the spacer, it aims at offering the manufacture approach of the liquid crystal display panel which makes migration of the substrate for re-alignment easy.

[0013] Furthermore, in case this invention closes liquid crystal between substrates by the vacuum dropping pouring-in method, it prevents the poor closure by the crack initiation of a closure member, and aims at offering the manufacture approach of the liquid crystal display panel which can improve the yield of a liquid crystal display panel. Furthermore, this invention reduces contamination of the liquid crystal produced by the exposure of the ultraviolet rays for closure member hardening, and aims at offering the manufacture approach of the liquid crystal display panel which can improve the display engine performance of a liquid crystal display panel.

[0014]

[Means for Solving the Problem] The process which applies a sealant 2 to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates 1 and 4 of a pair so that the above-mentioned technical problem may be illustrated to drawing 1 , The process which makes the particle 5 which has 0.2-0.6 micrometers or a path small 4 to 12% to the thickness of the liquid crystal layer which is going to form among the substrates 1 and 4 of said pair, and it is going to control adhere and fix to the field by the side of one electrode formation of the substrates 1 and 4 of said pair, The process which trickles the liquid crystal ingredient 3 on the field by the side of said electrode formation surrounded by said sealant 2, It solves by the manufacture approach of the liquid crystal display panel characterized by having the process which the field by the side of each electrode formation of the substrates 1 and 4 of said pair is made to counter, opens superposition and said liquid crystal ingredient 3 under reduced pressure, and forms said liquid crystal layer among the substrates 1 and 4 of said pair.

[0015] Or said particle is solved by the manufacture approach of said liquid crystal display panel characterized by being covered with adhesives and fixed to the field by the side of one [said] electrode formation. Or the process at which viscosity applies the sealant 2 of 50000 or more cp to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates 1 and 4 of a pair, The process which trickles the liquid crystal ingredient 3 into the field by the side of said electrode formation surrounded by said sealant 2, It solves by the manufacture approach of the liquid crystal display panel characterized by having the process which the field by the side of each electrode formation of the substrates 1 and 4 of said pair is made to counter, opens superposition and said liquid crystal ingredient 3 under reduced pressure, and forms said liquid crystal layer among the substrates 1 and 4 of said pair.

[0016] Or the process which forms at least frame 2a which consists of a sealant 21, and 2b along this field at a duplex on the field by the side of one [at least] electrode formation among the substrates 1 and 4 of a pair, The process of said sealant by the side of electrode formation of said substrates 1 and 4 which trickles the liquid crystal ingredient 3 in inside frame 2a most, It attains by the manufacture

approach of the liquid crystal display panel characterized by having the process which the field by the side of each electrode formation of the substrates 1 and 4 of said pair is made to counter, opens superposition and said liquid crystal ingredient 3 under reduced pressure, and forms said liquid crystal layer among the substrates 1 and 4 of said pair.

[0017] Or after closing said liquid crystal ingredient 3, it solves by the manufacture approach of said liquid crystal display panel characterized by leaving and excising frame 2a which consists at least one side of the substrates 1 and 4 of said pair of said sealant, and the No. 1 [at least] inside of the 2bs. Or the frame which consists of a sealant 2 of a photo-curing mold is applied to the field by the side of one [at least] electrode formation of the substrates 1 and 4 of a pair so that it may illustrate to drawing 1 and drawing 3 . The process which trickles the liquid crystal ingredient 3 into the field by the side of said electrode formation surrounded by this frame that arranges the protection-from-light means 8 near the inside of this frame, and consists of this sealant 2, It solves by the manufacture approach of the liquid crystal display panel characterized by having the process which the field by the side of each electrode formation of the substrates 1 and 4 of said pair is made to counter, and is piled up under reduced pressure, and the process which light is irradiated [process] at said sealant 2 and stiffens this sealant 2.

[0018] Or drawing 2 (a) It solves by the manufacture approach of said liquid crystal panel characterized by dropping said liquid crystal ingredient 3 using the dispenser which has the liquid crystal feed holes 13 to the down side, and has the needle 14 which is arranged in the liquid crystal ingredient container 11 with which internal pressure is maintained uniformly, and this liquid crystal ingredient container 11, and opens and closes these liquid crystal feed holes 13 so that it may illustrate.

[0019]

[work --] for According to this invention, when an overall diameter carries out adhesion immobilization of 0.2-0.6 micrometers or the particle small covered with the binder 4 to 12% at one substrate at least than the liquid crystal layer formed in the inside of the substrate of the pair which constitutes a liquid crystal display panel, migration of the substrate for performing re-alignment can be ensured, without damaging a substrate inside. This is having checked experimentally.

[0020] Moreover, a particle can be made to adhere to a substrate certainly by forming the frame of a sealant in the electrode formation side of a substrate, making a particle with adhesives adhere inside the substrate which counters, dropping liquid crystal within the limit of a sealant, and closing liquid crystal under reduced pressure. Therefore, a particle is passed by the rapid liquid crystal flow at the time of being filled up with liquid crystal between substrates etc., it can prevent inclining and distributing a particle on a substrate, and the homogeneity of the liquid crystal thickness between the substrates in a panel side can be raised. Since especially the particle of the above-mentioned path is easy to pass, there is wrap need in this particle with adhesives.

[0021] Moreover, since it is hard coming to damage a sealant by viscosity's adhering the sealant of 50000 or more cp to the electrode formation side of a substrate in the shape of a frame, dropping liquid crystal within the limit, and closing by reduced pressure-ization to external force, the poor closure of the sealant at the time of being filled up with liquid crystal between substrates can be reduced. Moreover, the frame of a sealant is prepared in a duplex at least along the direction of a substrate flat surface at the electrode formation side of a substrate, by [of the frame] dropping liquid crystal inside most and closing under reduced pressure, the differential pressure of sealant inside and outside at the time of enclosing liquid crystal is eased, and generating of the poor closure can be reduced. Moreover, by [of the frame of a sealant] leaving the inside most at least and removing a substrate, finally an unnecessary closure frame is removed and a liquid crystal display panel is simplified.

[0022] Furthermore, contamination of the liquid crystal which liquid crystal and a sealant react and produce can be prevented by irradiating ultraviolet rays by establishing a protection-from-light means near the inside of the frame of a photo-curing mold sealant to which it adhered at the electrode formation side of a substrate, dropping and enclosing a liquid crystal ingredient within the limit of a sealant, irradiating ultraviolet rays, and stiffening a sealant. Thereby, the display engine performance of a liquid crystal display panel can be raised.

[0023] Dropping of the liquid crystal ingredient in this invention is using the dispenser opened and closed with a needle. According to this, the drip was made to homogeneity with high degree of accuracy, and, moreover, it was checked experimentally that repeatability is good.
[0024]
[Example] Then, the example of this invention is explained based on a drawing below.
(The 1st example) Drawing 1 (a) - (e) It is the sectional view showing roughly the manufacture approach of the liquid crystal display panel concerning the 1st example of this invention.
[0025] In those drawings, although the first substrate 1 consists of glass etc., transparent electrodes and orientation film, such as ITO, are formed in the whole surface in fact, patterning of the circuits, such as a TFT component and a bus line, is carried out further and liquid crystal is supplied on the TFT component etc., a transparent electrode, TFT, etc. are omitted by a diagram, in order to clarify explanation. First, drawing 1 (a) The sealant 2 which consists of ultraviolet curing mold resin etc. is formed in the field by the side of electrode formation of the first substrate 1 in the shape of a frame, and the liquid crystal 3 of the specified quantity is dropped by the well-known approach inside the frame of a sealant 2 so that it may be shown. Moreover, the field where liquid crystal 3 was dropped among the first substrate 1 counters the adhesion side of the spacer 5 of the second substrate 4, and is arranged.
[0026] The second substrate 4 consists of transparent materials, such as glass and a quartz. Moreover, although a black matrix, a color filter, a common transparent electrode, and the orientation film are formed in the side which counters the first substrate 1 among the second substrate 4 in order, they are omitted in order to simplify explanation. Next, the sealant and spacer which were adopted by this example are explained.
[0027] (sealant) It is important to choose the sealing material of suitable viscosity so that a sealant 2 is for example, UV hardening mold, and serves as adhesives of the first and the second substrate 1 and 4 at a next process, it may be for dividing the space which moreover encloses liquid crystal 3 between substrates and a sealant 2 may not start the poor closure by the differential pressure of cel inside and outside in the case of restoration of liquid crystal 3.
[0028]
[Table 1]

封止材粘度(cp)	10,000	20,000	50,000	100,000
封止不良 (%)	40	80	2	0

[0029] Table 1 is a table having shown the relation between the viscosity of a sealant, and a closure percent defective. When the viscosity of a sealant is 20,000 or less cp, a closure percent defective is very high, and that viscosity of the incidence rate of a poor sealant is very low in 50,000 or more cp as this table shows. Therefore, it is desirable that viscosity uses the ingredient of 50,000 or more cp as a sealant 2.
[0030] (spacer) On the orientation film by the side of the second substrate 4 (un-illustrating), homogeneity sprinkles and adheres to the spacer 5. A spacer 5 is the particle of the magnitude of homogeneity and consists of almost spherical plastics etc. When the path of a spacer 5 pastes up the first and the second substrate 1 and 4 by the sealant 2, it is decided to make thickness of the liquid crystal layer between substrates into homogeneity over the whole. Moreover, the path of a spacer 5 must also take into consideration not barring the substrate migration in the case of the re-alignment of the first performed at a next process, and the second substrate 1 and 4.
[0031]
[Table 2]

液晶厚 (μm)	4.8	5.0	5.2	5.4	5.6	5.8
基板の移動	不可	不可	可	可	可	可
液晶厚ばらつき (μm)	±0.1	±0.1	±0.1	±0.1	±0.1	±0.15

[0032] Table 2 is a table in which the difference of the liquid crystal thickness between substrates and the diameter of a spacer showed how it would be related to migration of a substrate and liquid-crystal-thickness nonuniformity. Liquid-crystal-thickness nonuniformity shows the error of the thickness of the liquid crystal layer actually formed between substrates. Here, when a diameter changes the thickness of the liquid crystal layer of the first and the second substrate 1 and 4, using the 5 micrometers (Hayakawa Rubber make) spacer 5, the liquid-crystal-thickness nonuniformity in the whole condition and whole panel of substrate migration by substrate re-doubling is shown. The trial of migration of a substrate here was performed by fixing one substrate by the vacuum chuck, fixing the substrate of another side by another vacuum chuck, and applying the 50kg force to a longitudinal direction.
[0033] When liquid crystal thickness was 5.0 micrometers or less about migration of a substrate so that clearly from Table 2 that is, it was the same as the diameter of a spacer, or migration of a substrate was impossible when smaller than it. On the other hand, liquid crystal thickness was movable in 5.2 micrometers or more. About liquid-crystal-thickness nonuniformity, liquid crystal thickness became large by 5.8 micrometers, and it turned out by 5.6 micrometers or less that it is changeless.
[0034] When these are taken into consideration, and a diameter uses the spacer which is 5 micrometers, it is desirable to set liquid crystal thickness to 5.2-5.6 micrometers. That is, the greatest diameter of a spacer is understood that it is more desirable than the thickness of the liquid crystal layer between substrates to make it small 0.2-0.6 micrometers. That is, the thing of the thickness of the liquid crystal layer between substrates and the path of a spacer large about 4 to 12% is desirable. So, in this example, the thing with a diameter of 5 micrometers was used for the spacer 5, and liquid crystal thickness between the first and the second substrate 1 and 4 was set to 5.2 micrometers.
[0035] By the way, in order to make a spacer 5 adhere to the front face of the second substrate 4, the approach of mixing a spacer 5 with a solvent etc. and spraying on the front face of the second substrate 4 in a 80-90-degree C ambient atmosphere is adopted. According to this approach, before a spacer 5 reaches the second substrate 4, a solvent evaporates and only a spacer 5 adheres to the front face of the second substrate 4 in the state of a grain. At this time, the front face of the second substrate 4 adheres to a spacer 5 by adsorption [be / static electricity-/ it / chemical]. As other spacer adhering methods, a dry atomizing process etc. is sufficient.
[0036] Moreover, it is desirable to use as a spacer the spacer with which the coat of adhesives was formed in the front face, for example. It can prevent the second substrate's 4 adhering to a spacer 5 certainly by this, pouring a spacer 5 by liquid crystal flow etc., and distribution of a spacer 5 becoming an ununiformity. Therefore, the homogeneity of the thickness of the liquid crystal layer of the whole liquid crystal panel improves.
[0037] the strength of extent to which, as for such effectiveness, a spacer can resist the flow of liquid crystal -- or to say nothing of being what is produced by being fixed more than by it, it is not not necessarily the need that coat processing of the front face is carried out with adhesives. For example, naturally also in the spacer which processed and formed the bank which has the same level difference as the diameter of a spacer, effectiveness is produced.
[0038] At this example, in order to make the spacer (Hayakawa Rubber make) covered by adhesives adhere to the front face of the second substrate 4, heat treatment for 30 minutes was performed to adhesion processing of the conventional spacer at 150 degrees C. Thus, after having formed the sealant, adhering the spacer and making the first and the second substrate 1 and 4 rival, it is drawing 1 (b). The cel 6 between the first and the second substrate 1 and 4 is filled up with liquid crystal 3 so that it may be shown.
[0039] When filled up with the liquid crystal, the second substrate 4 is carried on the first substrate 1 with which liquid crystal 3 was dropped into the vacuum in those substrates 1 and 4, it presses down, and an ambient atmosphere is returned to atmospheric pressure from a vacuum in the place which the sealant 2 stuck with the front face of the second substrate 4. Since the interior of the cel 6 by which the closure was carried out is a vacuum and the outside of a cel 6 becomes atmospheric pressure by the sealant 2 at this time, by that differential pressure, the second substrate 4 can be drawn near to the direction of the first substrate 1, and liquid crystal 3 spreads along the field of the first and the second

substrate 1 and 4 as a result.
[0040] In this case, since liquid crystal 3 spreads inside a cel rapidly when returning a surrounding ambient atmosphere to atmospheric pressure, rapid flow arises in liquid crystal 3, but since the spacer with adhesives is used, it is washed away by the spacer 5 at the flow of liquid crystal 3, spacer distribution does not incline, and a spacer 5 can be maintained in the condition of having been distributed over homogeneity at this example. Moreover, although there is a big atmospheric-pressure difference in the inside and the outside of cap 6 at this time and a sealant 2 receives a big pressure, since un-**** [a sealant 2] still, the poor closure tends to produce it. However, since viscosity is using the ingredient of 50,000cp as a sealant 2 in this example, with the pressure, it is hard coming to win popularity damage, and generating of the poor closure can be reduced sharply.
[0041] When the condition that the gap 6 between the first and the second substrate 1 and 4 was completely filled up with liquid crystal 3 is shown, it is drawing 1 (c). Becoming like, the liquid crystal thickness becomes the predetermined value d. Liquid crystal thickness d is 5.2 micrometers here. Although not shown in drawing in detail, the spacer 5 is not in contact with the first front face and homogeneity of a substrate 1 in fact. Since the orientation film made of resin etc. is formed in each electrode formation side of the first and the second substrate 1 and 4, it is not flat and is irregular, and since the glass substrate itself has a curve further, liquid crystal thickness d serves as a bigger value than the diameter of a spacer 5.
[0042] At this time, since the sealant 2 has not hardened, it shifts the location of the first substrate 1 or the second substrate 4, and performs re-alignment. This process is performed under atmospheric pressure. At this time, since the path of a spacer 5 is smaller than the thickness of the liquid crystal layer between the first and the second substrate 1 and 4 0.2 micrometers, mutual migration of the first and the second substrate 1 and 4 is not barred, and re-alignment can be performed easily and certainly.
[0043] After re-alignment and drawing 1 (d) Irradiate ultraviolet rays 7 with a high pressure mercury vapor lamp at a sealant 2, it is made to harden, and the first and the second substrate 1 and 4 are fixed so that it may be shown. next, drawing 1 (e) **** -- the part outside the sealant 7 of the second substrate 4 is cut, and it removes with the unnecessary spacer 5 between the first in the exterior of a sealant 2, and the second substrate 1 and 4, and liquid crystal 3. Therefore, a liquid crystal display panel is simplified and it becomes easy to treat.
[0044] As mentioned above, at this example, by using a spacer with adhesives, homogeneity distribution of a spacer can be maintained over the whole panel, and the activity which took 1 hour or more in the 10 inch class conventionally is completed in several minutes. Moreover, substrate migration for the re-alignment of a substrate can be ensured now by using the spacer of a diameter smaller 0.2 micrometers than the thickness of the liquid crystal layer between substrates. Furthermore, as a sealant, since viscosity is using the sealing material of 50,000 or more cp, generating of the poor closure can be reduced and the yield of a liquid crystal panel can be improved.
[0045] It is not necessarily easy to create a liquid crystal panel so that the above conditions may be fulfilled. Although the thing of the diameter of various kinds is marketed and it is easily available about the diameter of a spacer, it becomes [a constant rate and] change of jurisdiction about liquid crystal whether it is dropped with repeatability sufficient with high precision, and supplies with the point of this technique. the result in which this invention person did investigation examination using various dispensers -- electromagnetism -- the thing of a closing motion type tip needle mold -- best -- and it found out that it could apply uniquely.
[0046] Table 3 is the result of investigating precision about various dispensers.
[0047]
[Table 3]

名　　称	内　　容	精　度
ｴｱｰﾌﾟｯｼｭﾌﾟﾙ 式	先端開状態でｴｱｰ 圧を変える	±２％以上
ﾁｭｰﾌﾞ（ﾛｰﾗﾎﾟﾝﾌﾟ）式	ﾁｭｰﾌﾞ中の液体をﾛｰﾙ で押す	±２％以上
電磁開閉先端ﾆｰﾄﾞﾙ式	常時一定圧力下でﾆｰﾄﾞﾙﾊﾞﾙﾌﾞ で開閉	±１％以下

[0048] electromagnetism -- the dispenser of a closing motion tip needle type -- for example, drawing 2 (a) It has structure as shown. Drawing 2 (a) It sets, the cap 12 with which the point sharpened is attached in the lower limit of the liquid crystal receipt machine 11 which contains liquid crystal 3, and one dipping hole 13 is formed in the center of the cap 12. Moreover, on the dipping hole 13 of cap 12, the movable needle 14 is arranged up and down by electromagnetic, and it is constituted so that the lower limit of a needle 14 may close or open the top hole of the dipping hole 13 by the vertical movement. Moreover, the interior of the liquid crystal receipt machine 11 is adjusted so that it may always become a constant pressure.
[0049] next, electromagnetism -- the liquid crystal dropping supply engine performance is shown in drawing using the dispenser of a closing motion tip needle type. For example, AKYURA Jetta by the no boss was used. Moreover, liquid crystal used ZLI-4792 (Merck make). The size of 4 kgf/cm2 and a needle 14 of the internal pressure of the liquid crystal receipt machine 11 is 26G.
[0050] It is drawing 2 (b) about the relation between dispensing time amount (open time amount of a needle valve), and a liquid crystal drip, and the experimental result of the liquid crystal drip per unit time amount at each [of dispensing time amount] time. It is shown. According to this experiment, good linear relation is between dispensing time amount and a liquid crystal drip, and the liquid crystal drip per unit time amount is fixed in a high precision.
[0051] next, electromagnetism -- when the precision and repeatability of a liquid crystal drip accompanying the increment in the shots per hour of liquid crystal by the dispenser of a closing motion tip needle type were examined, the result as shown in drawing 3 was obtained. According to this, when the shot of the liquid crystal was continuously carried out 100 times in two days, the error of the amount of dispensers is less than **1%, and high degree of accuracy and high repeatability were acquired. In addition, similarly the conditions of the shot on the 1st and the 2nd were set up.
[0052] electromagnetism -- it turns out that it is suitable also for the dropping pouring-in method which trickles liquid crystal in a vacuum ambient atmosphere since a structure top is possible also for using the dispenser of a closing motion tip needle type in a vacuum. In addition, generally liquid crystal is dropped in atmospheric pressure.
(The 2nd example) A light-shielding film is prepared in the inferior surface of tongue of the second substrate 4 which met the sealant 2 near the inside in order to prevent contamination of the liquid crystal 3 which prevents the reaction of the sealant 2 and liquid crystal 3 by ultraviolet rays 7, and is produced by the reaction in this example, and it is ********. The detail is given below.
[0053] Drawing 4 (a) The top view of the light-shielding film 8 formed in the second substrate 4, and drawing 4 (b) It is the sectional view. Drawing 4 (a) The light-shielding film 8 formed in the background through the second then transparent substrate 4 is shown. A light-shielding film 8 is the field which met inside the frame-like sealant 2, it is formed in the outside of a viewing area 9, and it is decided that it does not lap with a sealant 2 and a viewing area 9. If too near, since the formation field of a light-shielding film 8 laps with a sealant 2, or the part which is not hardened by the sealant 2 will arise, it is desirable to prepare few clearances between a light-shielding film 8 and a sealant 2. Moreover, although a light-shielding film 8 may be formed in the second substrate 4 bottom, from the point of protection-from-light precision, its second substrate 4 bottom is more desirable.
[0054] If a light-shielding film 8 carries out patterning of the film (for example, chromium film) which constitutes the black matrix film formed in the second substrate 4 and it is formed in order to raise display quality, it does not make a production process complicate. In order to stiffen a sealant 2, in case ultraviolet rays are irradiated, it is drawing 4 (b) to the exterior of the first and the second substrate 1.4. The protection-from-light mask [like] 10 is placed, and the UV irradiation of a viewing area 9 is prevented. It is because the protection-from-light field by the light-shielding film 8 is restricted between the viewing area 9 and the formation field of a sealant 2.
[0055] Moreover, although a light-shielding film may be prepared in the first substrate 1 side when irradiating ultraviolet rays from the first substrate 1 side and stiffening a sealant 7, wiring of a bus line etc. is formed in the first substrate 1 with metals, such as aluminum, therefore, as for a light-shielding

film, forming with an insulating ingredient is desirable. Thus, since the amount of ultraviolet rays irradiated by the about two-sealant liquid crystal 3 by forming a light-shielding film 8 can be lessened sharply, the reaction of the sealant 2 and liquid crystal 3 by UV irradiation can be reduced, and contamination of liquid crystal 7 can be lessened extremely. And with the external protection-from-light mask 10, the reaction of the liquid crystal in a viewing area and the minute amount molecule of a sealant 2 was prevented, and generating of contamination of liquid crystal 7 is controlled.

[0056] As mentioned above, in this example, since he is trying to prevent the UV irradiation of the liquid crystal near the sealant, contamination of the liquid crystal by the reaction of a sealant 2 and liquid crystal 4 is avoidable in the case of sealant hardening by UV irradiation. As described above, when it shaded and liquid crystal electric resistance was fallen by evaluation of electrical-potential-difference retention, using T-470 (a cationic polymerization mold, the product made from the Nagase tiba, 100,000cp) as a sealant, most decline in liquid crystal retention was not seen. In addition, as liquid crystal 3, ZLI-4792 (Merck make) is used and the exposure conditions of the ultraviolet rays of a sealant 2 are 5000mJ/cm2. It carried out.

[0057] It becomes unnecessary in addition, to make ultraviolet rays into the shape of a beam, to irradiate only the frame-like sealant 2, and to use a light-shielding film in this case.

(The 3rd example) Although overall flow is the same as what explained the manufacture approach of the liquid crystal display panel concerning the 3rd example of this invention in the 1st example, the formation approaches of the sealant for closing two substrates which counter differ.

[0058] Drawing 5 (a) and (b) It is the top view and sectional view of a liquid crystal display panel in the condition that liquid crystal was enclosed. Drawing 5 (a) It sets, sealant 2b is formed in the outside of sealant 2a in a panel, and liquid crystal 3 is enclosed inside sealant 2a. The space between sealant 2a and 2b is a vacuum, and the outside of sealant 2b is atmospheric air. Before piling up the first and the second substrate 1 and 4, sealant 2a and 2b are made to adhere to the first substrate 1 in a vacuum, in order to form sealant 2a of such a duplex, and 2b. And if the first and the second substrate 1 and 4 are piled up, it pastes up and an ambient atmosphere is made into atmospheric pressure, the first and the second substrate 1 and 4 can draw near, and the interior of sealant 2a will be filled up with liquid crystal 3. Although the outside of sealant 2b becomes atmospheric pressure at this time, it is still a vacuum between sealant 2a and sealant 2b.

[0059] In case a surrounding ambient atmosphere is made into atmospheric pressure and liquid crystal 3 is enclosed between substrates, the inside of sealant 2a is a vacuum mostly until it fills up with liquid crystal 3 completely inside sealant 2a. However, it can change into the condition of having also made the outside of sealant 2a into the vacuum, by preparing a sealant in a duplex in this way. Therefore, it can prevent rapid differential pressure arising within and without sealant 2a, and generating of the poor closure of sealant 2a can be avoided.

[0060] Moreover, after completing enclosure of liquid crystal 3 and stiffening sealant 2a at least, an outside [a / of the second substrate 4 / sealant 2] is cut and removed. Therefore, the ingredient of sealant 2b is seldom limited but can use various ingredients. Thus, by preparing the frame of a sealant in a duplex, the poor closure can be reduced and the yield of a liquid crystal panel can be improved.

[0061]

[Effect of the Invention] As stated above, according to this invention, form the frame of a sealant in the substrate which has a transparent electrode etc., and liquid crystal is dropped at it within the limit. In the liquid crystal display panel which liquid crystal is enclosed [panel] between substrates and stiffens a sealant by piling up in a vacuum another substrate to which the spacer was made to adhere, and returning a perimeter to atmospheric pressure, and its manufacture approach By using what has a diameter smaller at least 0.2 micrometers than the thickness of the liquid crystal layer between substrates as a spacer, migration of the substrate in the case of re-alignment can be ensured, maintaining the homogeneity of the thickness of the liquid crystal layer between substrates.

[0062] Moreover, it can prevent pouring a spacer by liquid crystal flow and distribution of a spacer inclining by using a spacer with adhesives as a spacer. Thereby, the homogeneity of the thickness of the liquid crystal layer between the substrates over the whole panel improves. Moreover, when viscosity

uses the thing of 50000 or more cp as a sealant, since a sealant becomes strong to external force, the poor closure can be reduced. Furthermore, since the internal and external differential pressure of the frame which closes liquid crystal by preparing the frame of a sealant in a duplex can be eased, the poor closure can be reduced. Thereby, the yield of a liquid crystal display panel can be raised.
[0063] Moreover, since contamination of the liquid crystal which liquid crystal and a sealant react by ultraviolet rays, and is produced by preparing a light-shielding film near the sealant of a substrate can be prevented even when irradiating ultraviolet rays, in case it is made to harden as a sealant using the ingredient of an ultraviolet curing mold, the display engine performance of a liquid crystal display panel can be raised and stabilized. Since dropping of the liquid crystal ingredient in this invention is using the dispenser opened and closed with a needle, it can equalize a drip with high degree of accuracy, and, moreover, repeatability improves.

[Translation done.]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of the liquid crystal display panel characterized by providing the following. The process which applies a sealant to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates of a pair The process which makes the particle which has 0.2-0.6 micrometers or a path small 4 to 12% to the thickness of the liquid crystal layer which is going to form between the substrates of said pair and it is going to control adhere and fix to the field by the side of one electrode formation of the substrates of said pair The process which trickles a liquid crystal ingredient on the field by the side of said electrode formation surrounded by said sealant The process which the field by the side of said one pair of each electrode formation of a substrate is made to counter, opens superposition and said liquid crystal ingredient under reduced pressure, and forms said liquid crystal layer between the substrates of said pair
[Claim 2] Said particle is the manufacture approach of the liquid crystal display panel according to claim 1 characterized by being covered with adhesives and fixed to the field by the side of one [said] electrode formation.
[Claim 3] The manufacture approach of the liquid crystal display panel characterized by providing the following. The process at which viscosity applies the sealant of 50000 or more cp to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates of a pair The process which trickles a liquid crystal ingredient into the field by the side of said electrode formation surrounded by said sealant The process which the field by the side of each electrode formation of the substrate of said pair is made to counter, opens superposition and said liquid crystal ingredient under reduced pressure, and forms said liquid crystal layer between the substrates of said pair
[Claim 4] The manufacture approach of the liquid crystal display panel characterized by providing the following. The process which forms at least the frame which consists of a sealant along this field at a duplex on the field by the side of one [at least] electrode formation among the substrates of a pair The process of said sealant by the side of electrode formation of said substrate which trickles a liquid crystal ingredient within the inside limit most The process which the field by the side of each electrode formation of the substrate of said pair is made to counter, opens superposition and said liquid crystal ingredient under reduced pressure, and forms said liquid crystal layer between the substrates of said pair
[Claim 5] The manufacture approach of the liquid crystal display panel according to claim 4 characterized by leaving and excising the No. 1 [at least] inside of the frames which consist at least one side of the substrate of said pair of said sealant after closing said liquid crystal ingredient.
[Claim 6] The manufacture approach of the liquid crystal display panel characterized by providing the following. The process which trickles a liquid crystal ingredient into the field by the side of said electrode formation surrounded by this frame that applies to the field by the side of one [at least] electrode formation of the substrates of a pair the frame which consists of a sealant of a photo-curing mold, arranges a protection-from-light means near the inside of this frame, and consists of this sealant The process which the field by the side of each electrode formation of the substrate of said pair is made to counter, and is piled up under reduced pressure The process which light is irradiated [process] at said

sealant and stiffens this sealant
[Claim 7] The manufacture approach of the liquid crystal panel according to claim 1, 3, 4, or 6 characterized by dropping said liquid crystal ingredient using the dispenser which has liquid crystal feed holes to the down side, and has the needle which is arranged in the liquid crystal ingredient container with which internal pressure is maintained uniformly, and this liquid crystal ingredient container, and opens and closes these liquid crystal feed holes.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 (a) - (e) It is the sectional view showing roughly the manufacture approach of the liquid crystal display panel concerning the 1st example of this invention.
[Drawing 2] drawing 2 (a) the electromagnetism used for the 1st example of this invention -- the sectional view and drawing 2 (b) which show the outline of the liquid crystal dispenser of a closing motion tip needle type They are the graph which shows the relation between TISU penny time amount and the amount of dispensing, and the graph which shows change of the amount of dispensing per [in alignment with the dispensing passage of time] unit time amount.
[Drawing 3] drawing 3 -- electromagnetism -- it is the graph which shows the relation between the count of a shot by the liquid crystal dispenser of a closing motion tip needle type, and the amount of dispensing.
[Drawing 4] One process of the manufacture approach of the liquid crystal display panel shown in drawing 1 is shown in a detail, and it is drawing 4 (a). A top view and drawing 4 (b) It is a sectional view.
[Drawing 5] One process of the manufacture approach of the liquid crystal display panel concerning the 2nd example of this invention is shown, and it is drawing 5 (a). A top view and drawing 5 (b) It is a sectional view.
[Drawing 6] The manufacture approach of a liquid crystal display panel is shown roughly, and it is drawing 6 (a). - (c) It is the perspective view showing each process, respectively.
[Drawing 7] It is the top view showing the poor closure of the sealant produced by the manufacture approach of the conventional liquid crystal display panel.
[Drawing 8] In the manufacture approach of the conventional liquid crystal display panel, it is the graph which shows change of the electrical-potential-difference retention of the liquid crystal of the location where it differs in a panel.
[Description of Notations]
1, 4, 21, 24 Substrate
2, 2a, 2b, 22 Sealant
3 23 Liquid crystal
5 Spacer
6 Cel
7 Ultraviolet Rays
8 Light-shielding Film
9 Viewing Area
10 Protection-from-Light Member
11 Liquid Crystal Receipt Machine
12 Cap
13 Dipping Hole
14 Needle

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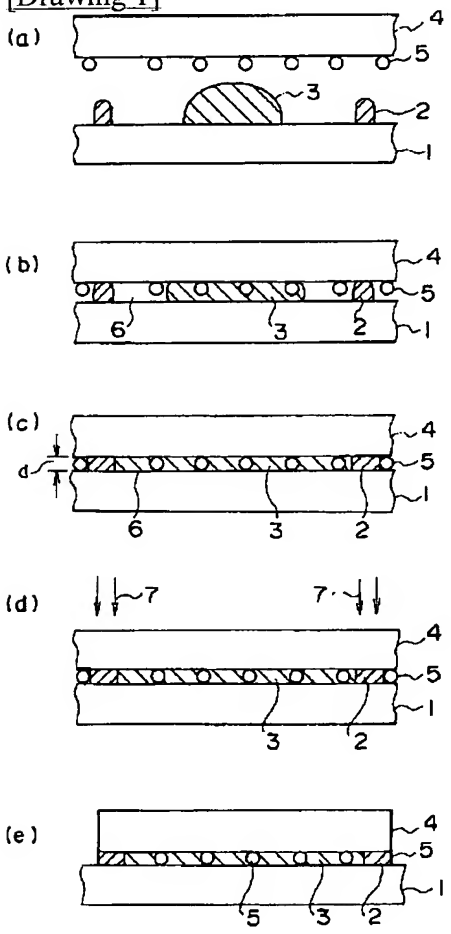
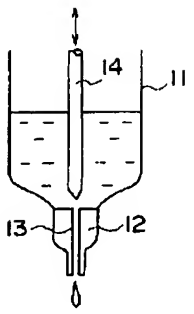
DRAWINGS

[Drawing 1]

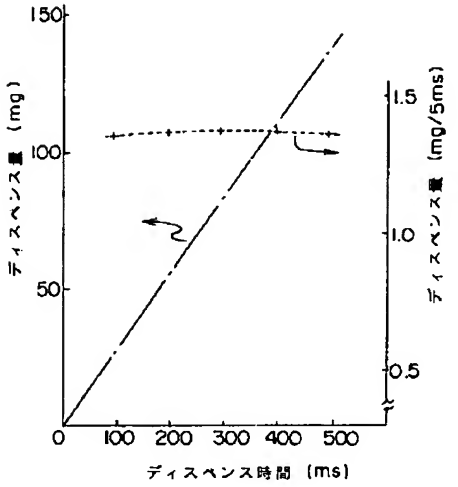


[Drawing 2]

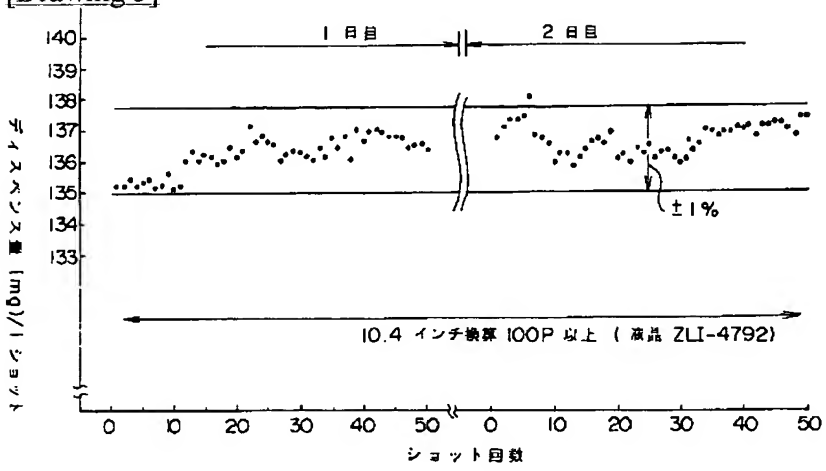
(a)



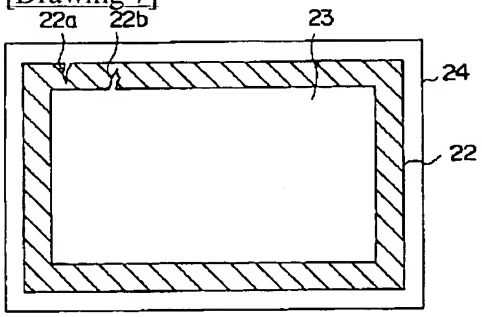
(b)



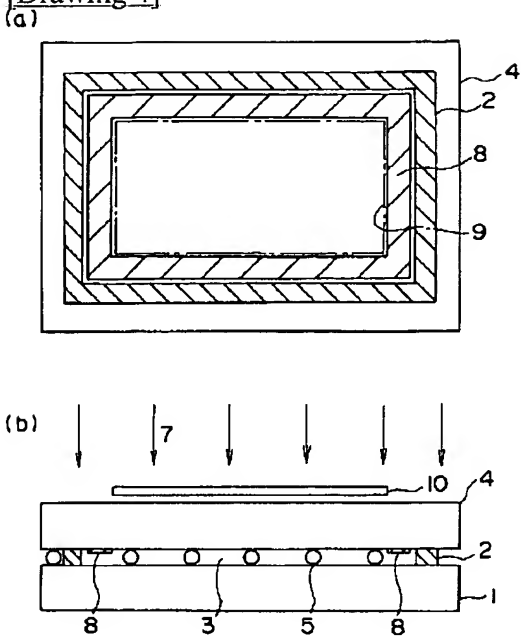
[Drawing 3]



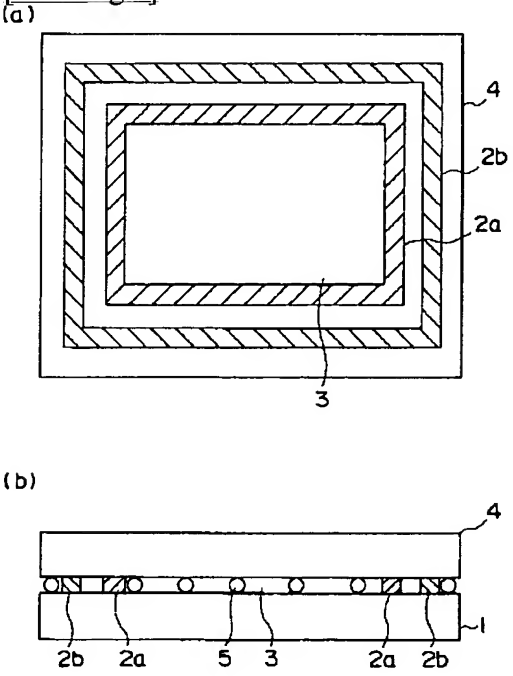
[Drawing 7]



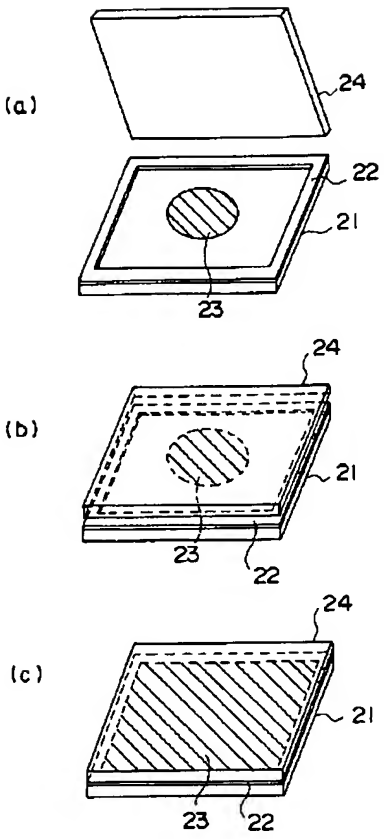
[Drawing 4]



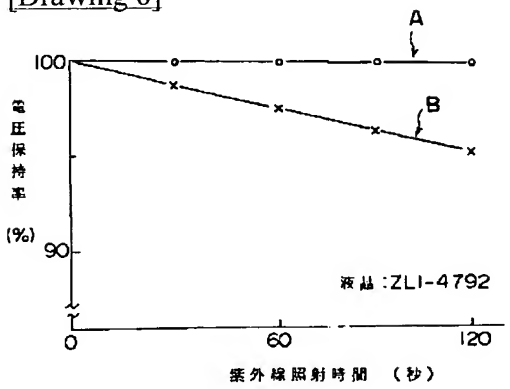
[Drawing 5]



[Drawing 6]



[Drawing 8]



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